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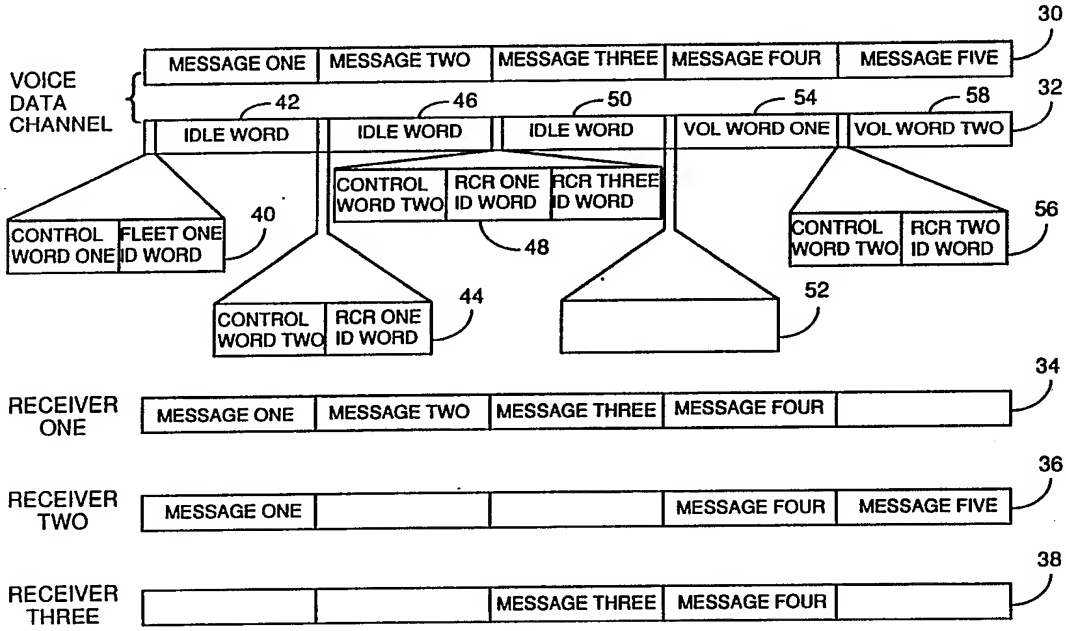

(57) Abstract

A transmitter transmits a control signal (32) and a message (30) on the same voice/data channel to at least one receiver (12). Control signal (32) comprises code words (40, 44) to designate which receiver (12) is not to have the volume reduced to zero. The control signal (32) also controls the magnitude of the volume of the recovered or received message (30) and is non-audible so that it is not heard by the person listening to the message (30). The time duration of a control signal (54) determines the time that the message (30) will be at the controlled volume magnitude.

* See back of page

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RF RECEIVER HAVING REMOTE VOLUME CONTROL

Field of the Invention

This invention relates in general to transmitters and receivers in a radio frequency (RF) transmission system and in particular to a method for remotely controlling the magnitude of the audio output volume of an RF receiver.

Background of the Invention

In transmission of radio messages, it is important at times to insure that a message is heard by only a select few receivers operating on a channel or by a predetermined group of receivers on one channel. Generally, the messages carry information to the receivers in the form of audio messages or tones that have specific meaning to the particular receiver. Some trunking systems allow the transmitter to designate which receivers receive a message by using control signals on a channel separate from the channel on which the message is broadcast. But a trunking system requires transmitters and receivers capable of functioning on two or more channels.

Through the use of two-way radio transceivers with Private Line (PL) or Digital Private Line (DPL) capability, the receivers targeted for reception of the message can be selectively activated (i.e. turned on) through the use of signals on the same channel as the message. PL radio systems transmit a low frequency tone, usually less than 300 Hz, for the duration of the message. The specific frequency of the low frequency tone determines which RF receivers are to receive the message. A receiver will only operate to receive a message if it is receiving an identified tone. The receiver shuts off (or enters a standby mode) when the tone is no longer received. DPL radio systems preface each message with a short burst of digital data containing a preset digital code word for activating selected receivers. If the received code word

correlates with a digital code word stored internally, the receiver will operate to receive the message. At the end of a DPL transmission, the inverse of the digital code word is transmitted, shutting off the receiver.

To install PL and DPL capabilities in a radio receiver, extra circuitry within the receiver is required. Further, DPL radio systems are constrained to use the same code word without allowing any user selectivity. This could cause problems if several systems are utilizing the same channel in overlapping network coverage areas. Also, after a receiver is muted by the DPL code word, pressing a reset button on the muted receiver will activate the receiver and allow reception of the unintended message. This results from the DPL code word keying up the receiver in the same manner as the on/off switch or the reset button key up the receiver.

Many persons carrying two-way mobile transceivers and paging receivers tend to turn the volume down to avoid the noise emanating from the receiver. Also, after hours of listening to a receiver the human ear tends to tune out the noise. There are times when a dispatcher wishes to insure that the receiver hears the entire message. Usually, the dispatcher must repeat the message over and over until he receives some confirmation that the message was received. Without a way of controlling the reception volume, the dispatcher is unable to provide the more important messages at a louder volume.

Thus, what is needed is a method and apparatus for controlling the audio output of a speaker in a receiver from a transmitter by either muting the audio output to select which receivers will output a message or set the audio output at full volume for emphasis.

Summary of the Invention

Accordingly, it is an object of the present invention to provide a method and an apparatus for controlling the

volume of audio output from a radio receiver in response to a control signal.

In carrying out the above and other objects of the invention in one form, there is provided a transmitter for transmitting a control signal and a message on the same voice/data channel to at least one receiver. The control signal controls the magnitude of the volume of the message and is non-audible such that it is not heard by the person listening to the message.

Brief Description of the Drawing

FIG. 1 is a diagram of radio network system according to the present invention.

FIG. 2 is a diagram of the signals appearing on the transmission channel according to the present invention.

FIG. 3 is a block diagram of a receiver according to the present invention.

Detailed Description of the Invention

Referring to FIG. 1, a transmitter 10 transmits signals on a common channel, in the preferred embodiment a single voice/data channel to a plurality of receivers 12a, 12b, and 12c within the transmitter's broadcast area 14. Preferably, the signal comprises three portions: a signal from an audio source 16 comprising a message to be transmitted, a non-audible signal which in the preferred embodiment is a subaudible signal from a subaudible control word generator 18 comprising a control word to remotely control the volume of one or more of the receivers 12a, 12b, and 12c, and a signal from an encoder 20 identifying the RF carrier and other transmission information.

Referring to FIG. 2, an audible signal line 30 represents an exemplary illustration of the audio portion of signals on the voice/data channel and comprises MESSAGE ONE, MESSAGE TWO, MESSAGE THREE, MESSAGE FOUR, and MESSAGE FIVE. A subaudible control signal line 32 depicts the

concurrently transmitted control signals at a subaudible frequency, for example less than 300 Hz. An example of the concurrent reception of the audio signal at three receivers, RECEIVER ONE, RECEIVER TWO, and RECEIVER THREE is shown at reception lines 34, 36 and 38, respectively.

During the transmission of MESSAGE ONE on the audible signal line 30, the control signals on the subaudible control signal line 32 comprise a control portion 40 and an idle portion 42. The receivers are initially divided into groups of receivers called fleets. In the exemplary situation depicted, Fleet One consists of RECEIVER ONE and RECEIVER TWO. During the control portion 40 of the transmission, a binary control word CONTROL WORD ONE is transmitted indicating that the receivers are to operate in a fleet mute mode whereby at least one fleet of receivers is to receive MESSAGE ONE. Following CONTROL WORD ONE, identification signal FLEET ONE ID WORD is transmitted indicating which fleet of receivers are not to be muted. The predetermined fleet identification words are assigned when the receivers are initially divided into fleets. IDLE WORD 42 is transmitted for the remainder of the transmission time of MESSAGE ONE to specify that the control placed upon the identified fleets during control portion 40 of the control signal transmission continues for the time duration of the transmission of IDLE WORD 42. When the transmitter ceases to transmit IDLE WORD, the control placed upon the identified fleets ceases. Therefore, RECEIVER THREE will not receive any portion of MESSAGE ONE. In the preferred operation, if more fleets are to receive the message than to be muted, the binary inverse of CONTROL WORD ONE indicates that the fleets identified by the following fleet identification words will be muted. Thus, the transmission of INVERSE CONTROL WORD ONE followed by FLEET TWO ID WORD, where Fleet Two comprises RECEIVER THREE, would achieve the same reception results.

During the transmission of MESSAGE TWO on the audible signal line 30, the control portion 44 includes the

transmission of the binary control word CONTROL WORD TWO indicating that the receivers are to operate in an individual mute mode whereby at least one receiver is to receive MESSAGE TWO. Following CONTROL WORD TWO, identification signals are transmitted indicating which receivers are not to be muted. MESSAGE TWO is to be sent to RECEIVER ONE, as indicated by RCR ONE ID WORD. RECEIVER TWO and RECEIVER THREE will be muted. IDLE WORD 46 is transmitted for the remainder of the transmission time of MESSAGE ONE and specifies the time duration that the control placed upon the identified receivers during control portion 44 of the control signal transmission will remain. Therefore, RECEIVER TWO and RECEIVER THREE will be muted during the entire transmission of MESSAGE TWO. IDLE WORD 46 can be the same signal as IDLE WORD 42 or different idle signals can be used for controlling different receivers.

MESSAGE THREE is transmitted on the audible signal line 30 while the control portion 48 of the transmission and IDLE WORD 50 are transmitted. Following CONTROL WORD TWO, identification signals are transmitted indicating that RECEIVER ONE and RECEIVER THREE are not to be muted. IDLE WORD 50 is transmitted for the remainder of the transmission time of MESSAGE THREE to indicate that the control placed upon the identified receivers during control portion 40 of the control signal transmission will remain for the time duration of the transmission of IDLE WORD. Therefore, RECEIVER TWO will not receive any portion of MESSAGE THREE. In the preferred operation, if more receivers are to receive the message than to be muted, the binary inverse of CONTROL WORD TWO indicates that the receivers identified by the following identification words will be muted. Thus, the transmission of INVERSE CONTROL WORD TWO followed by RCR TWO ID WORD would achieve the same reception results.

MESSAGE FOUR is transmitted on the audible signal line 30 concurrently with the subaudible transmission of the control portion 52 and VOL WORD ONE 54 on subaudible signal line 32. Control portion 52 contains no control signals or

a non-mute code specifying that all of the receivers will receive the message, i.e., none of the receivers will be muted. VOL WORD ONE 54 is transmitted for the remainder of the transmission time of MESSAGE FOUR to indicate that the volume of the audio output device in each of the receivers will be set to a predetermined magnitude and to specify that the receivers will remain at that volume magnitude for the duration of the transmission of VOL WORD ONE 54. The volume control words each define a volume magnitude level from near mute to full volume.

As with exemplary MESSAGE TWO above, control portion 56 and idle portion 58 provide that MESSAGE FIVE will be received by RECEIVER TWO and the audio output volume of MESSAGE FIVE will have a predetermined volume magnitude defined by VOL WORD TWO.

Referring to FIG.3, the composite signal comprising an audible signal 30 and a subaudible control signal 32 (FIG. 2) is received at an antenna 60 of a receiver 12. A receiver circuit 62 includes a conventional receiver combined with a demodulator adapted to process analog signals, which are provided to an audio switch 64, and digitally encoded data, which is provided to a microprocessor 66. The binary data is decoded in the microprocessor and provided as one input to an AND gate 68, whose output is coupled to an audio amplifier 70 for turning the amplifier 70 off and on. The other input to the AND gate 68 is from user controls 72 such as reset controls and squelch controls. The user controls 72 can access portions of the microprocessor 66 to perform the control functions. The analog signals provided to the audio switch 64 in normal operation pass through a variable resistor 74 for user volume control and thence to the audio power amplifier 70. The signals are amplified and provided to a speaker or other audio output device 76 for presenting audio output to the user of the receiver. During remote volume control operation, binary control signals are decoded by the microprocessor 66 and passed to a volume level switch 78, which routes the analog signals through

one of a plurality of resistors within a predetermined volume control 80, thereby providing the audible message at one of eight predetermined magnitudes of volume in the preferred embodiment

CLAIMS

1. A method for remote volume control comprising the step of presenting a received audible message at a volume level determined in response to a non-audible control signal received over a common channel as the audible message.

2. A method for remote volume control comprising the steps of:

(a) receiving a signal comprising at least an audible message and a non-audible control signal; and

(b) presenting the audible message at a volume level determined in response to the non-audible control signal.

3. The method according to Claim 2 further comprising the step of specifying a time duration that the audible message is presented at said volume level.

4. In a communication system having a plurality of selective call receivers operating therein, a method for remotely controlling which of the plurality of selective call receivers may receive a message, comprising the steps of:

at a transmitter:

(a) transmitting an audible message and a non-audible control signal over a common channel, the non-audible control signal identifying which of the plurality of receivers may receiver the audible message and at what volume the audible message should be presented;

in at least one of the plurality of selective call receivers:

(a) receiving the audible message and non-audible control signal;

(b) determining whether to present the audible message; and

(c) presenting the audible message at a volume level identified by the control signal when it is determined that the audible message should be presented.

5. A system comprising:

transmitter means for transmitting a non-audible control signal and a message on a common channel; and

at least one receiver including an audio output device for audibly presenting said message at a volume level, said non-audible control signal selectively controlling the volume level.

6. The system according to Claim 5 wherein said non-audible control signal comprises a timing means for specifying a time duration that said message is presented at said volume level.

7. The system according to Claim 5 wherein said non-audible control signal comprises at least one identification means for identifying which of said at least one receiver will have its volume level controlled.

8. The system according to Claim 5, wherein said at least one receiver comprises a plurality of receivers divided into a plurality of groups and said non-audible control signal comprises at least one identification signal for identifying at least one of said plurality of groups that will have their volume levels controlled.

9. A receiver comprising:

a receiver circuit for receiving a signal comprising a message and a non-audible control signal on a common channel;

an output device coupled to said receiver circuit for presenting said message at a volume level; and

control means for selectively controlling the volume level in response to said non-audible control signal.

10. The receiver according to Claim 9 wherein said non-audible control signal further specifies the time duration that said volume level is controlled.

11. A method comprising the step of receiving a message and a non-audible control signal on a common channel, said non-audible control signal controlling an output volume level of at least one of a plurality of audio output devices on a plurality of receivers.

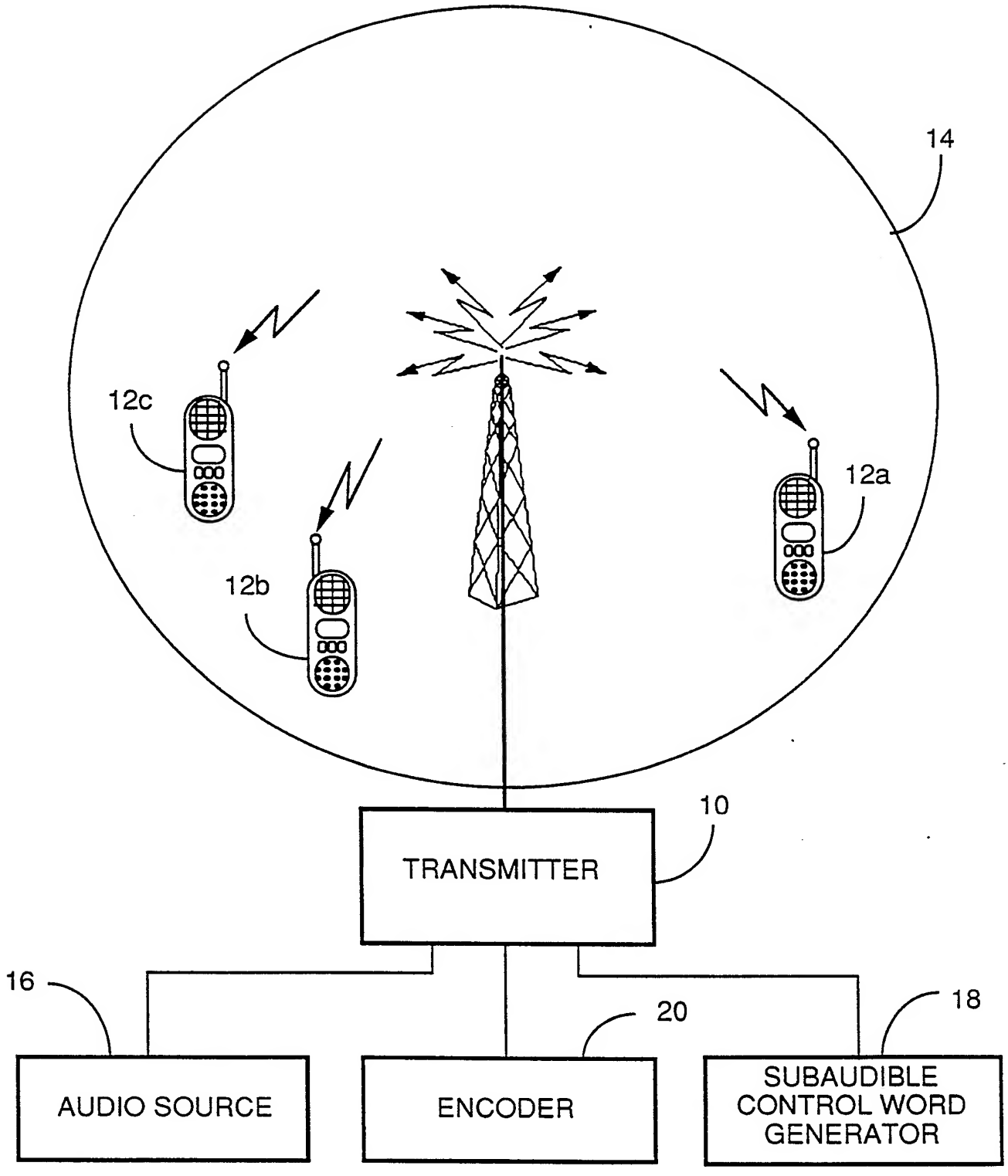
14
12c
12b
12a
10
TRANSMITTER
16
20
18
AUDIO SOURCE
ENCODER
SUBAUDIBLE CONTROL WORD GENERATOR

FIG. 1

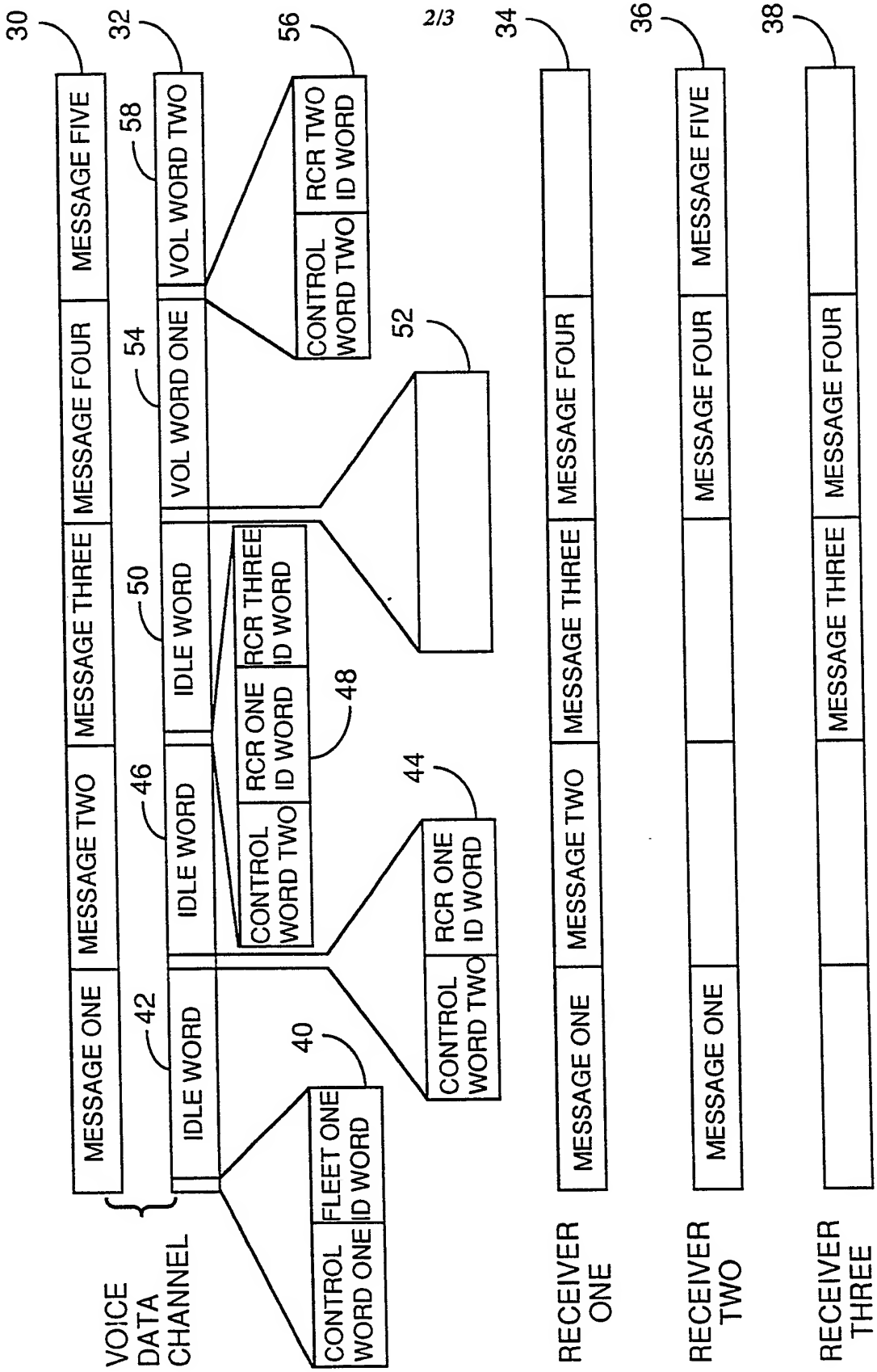
30
32
34
36
38
MESSAGE ONE
MESSAGE TWO
MESSAGE THREE
MESSAGE FOUR
MESSAGE FIVE
VOICE DATA CHANNEL
RECEIVER ONE
RECEIVER TWO
RECEIVER THREE
42
IDLE WORD
40
CONTROL WORD ONE
FLEET ONE ID WORD
46
IDLE WORD
CONTROL WORD TWO
RCR ONE ID WORD
RCR THREE ID WORD
48
50
IDLE WORD
54
VOL WORD ONE
58
VOL WORD TWO
56
CONTROL WORD TWO
RCR TWO ID WORD
44
CONTROL WORD TWO
RCR ONE ID WORD
52

FIG. 2

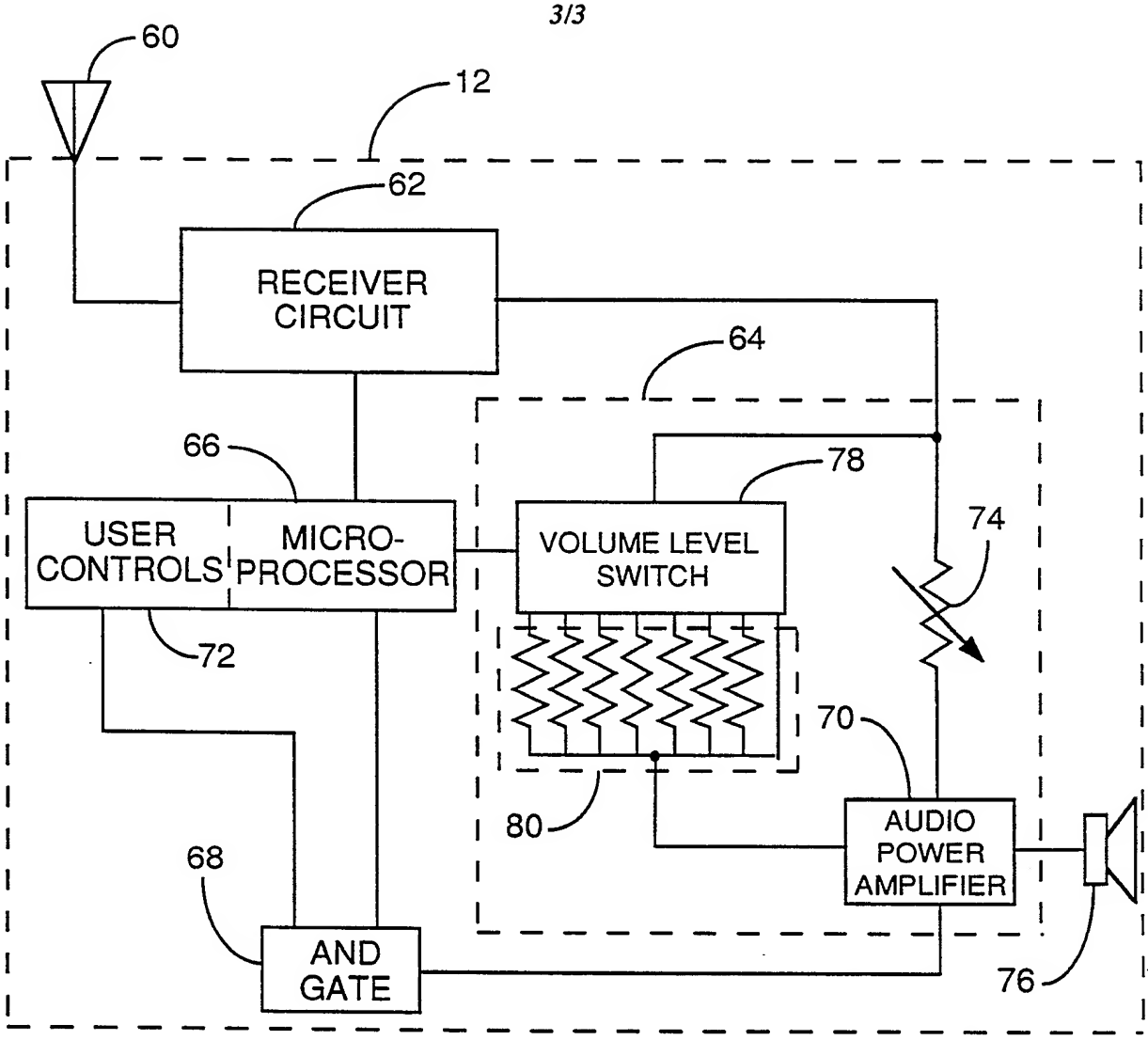
60
12
62
RECEIVER CIRCUIT
64
66
78
USER CONTROLS
MICRO-PROCESSOR
VOLUME LEVEL SWITCH
74
72
70
80
AUDIO POWER AMPLIFIER
68
AND GATE
76

FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/US90/04428

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 3

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(5): H04H 1/00
U.S. CL. 455/68

II. FIELDS SEARCHED

Minimum Documentation Searched 4	
Classification System	Classification Symbols
U.S.	455/68,70,200,222,234.57 381/104,107 340/825.44

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 5

III. DOCUMENTS CONSIDERED TO BE RELEVANT 14

Category *	Citation of Document, 16 with indication, where appropriate, of the relevant passages 17	Relevant to Claim No. 18
Y	FR, A, 2266-388 (THEVENIN) 24 OCTOBER 1975 See Abstract	1-11
Y	U.S., A, 4,517,561 (BURKE ET AL) 14 MAY 1985, See fig. 2 col. 5, lines 43-54	4
A	U.S., A 3,889,059 (THOMPSON ET AL) 10 JUNE 1975 See Abstract	1-11
A	U.S., A, 3,582,788 (CASTAGNA) 01 JUNE 1971 See Abstract	1-11

* Special categories of cited documents: 15

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search 2	Date of Mailing of this International Search Report 2
15 NOVEMBER 1990	15 JAN 1991
International Searching Authority 1	**Signature of Authorized Officer 20**
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